

# Drayton SHR 521 20

Installation  
Commissioning  
Operation  
Fault finding  
Examples



# SHR 521 20



manual



49000720

Thank you for buying a Drayton product.  
Please read this manual carefully to get the best performance from this unit.

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**Security advice**

Please pay attention to the following security advice in order to avoid danger and damage to people and property.

**Instructions**

Attention should be paid

- to the statutory provisions for prevention of industrial accidents,
- to the statutory provisions for environmental protection,
- to the Health and Safety at Work Act 1974
- to Part P of the Building Regulations 2005
- to BS7671 Requirements for electrical installations and relevant safety regulations of DIN, EN, DVGW, TRGI, TRF and VDE.

This instruction is exclusively addressed to authorised skilled personnel.

- Only qualified electricians should carry out electrical works.
- Initial installation should be effected by named qualified personnel

**Declaration of conformity**

We, Invensys Controls Europe, declare under our sole responsibility that our product SHR 52120 complies with the following standards:

EN 55 014-1

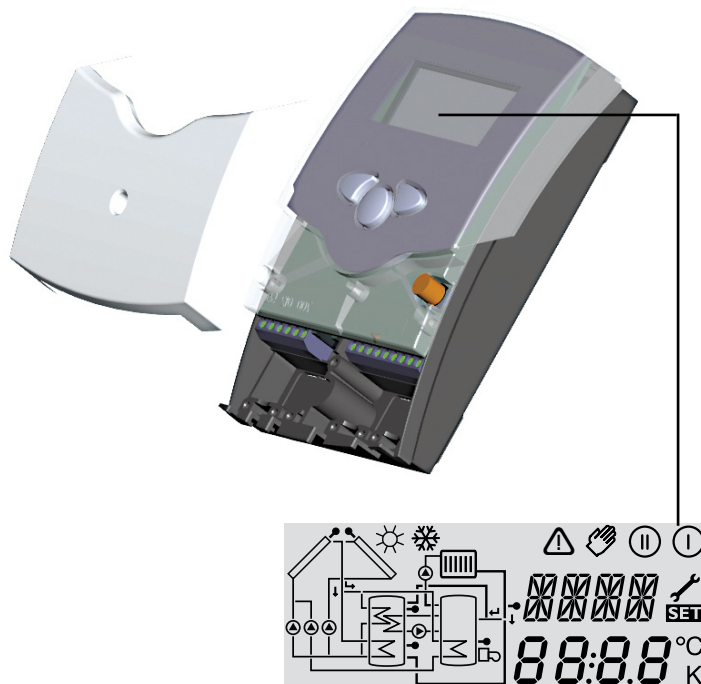
EN 60 730-1

According to the regulations of the above directives, the product is labelled with **CE**:

89/336/EWG

73/ 23/EWG

- Backlit multifunction display to monitor solar thermal systems
- Up to 4 Pt1000 temperature sensors
- Heat balancing
- Stylish, easy-to-install housing
- Simple 3-button operation
- Solar operating hours counter and thermostat function

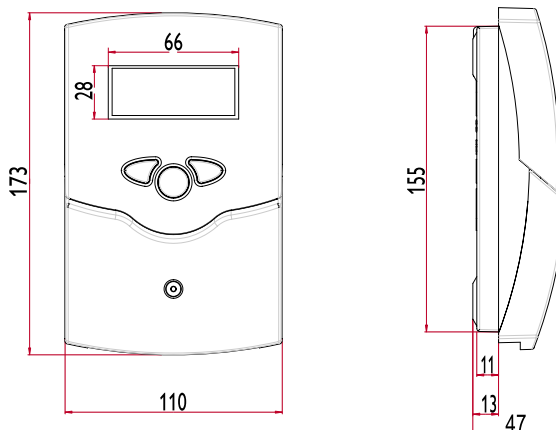


#### Parts included:

- 1 x SHR 521 20
- 1 x accessory bag
  - 1 x spare fuse T4A
  - 2 x screws and wall plugs
  - 4 x cable clamps and screws

Additionally enclosed in the full kit:

- 1 x sensor FKP6
- 1 x sensor FRP6



#### Technical data

##### Housing:

plastic, PC-ABS and PMMA

**Protection type:** IP 20 / DIN 40050

**Ambient temp.:** 0 ... 40 °C

**Size:** 172 x 110 x 46 mm

**Mounting:** wall mounting, panels mounting is possible

**Display:** System screen for system visualisation, 16-segment display, 7-segment display, 8 symbols for system status and operating control lamp

**Operation:** by 3 pushbuttons on the front of the housing

**Functions:** Temperature differential controller with optional system functions. System monitoring according to BAW-guidelines, operating hours counter for solar pump, tube collector special function, as well as heat quantity balancing.

**Inputs:** for 4 Pt1000 temperature sensors

**Outputs:** depending on version, see section „controller versions“

##### Power supply:

220 ... 240V~

##### Switching Capacity:

4 (2) A 220 ... 240V~

##### Mode of operation:

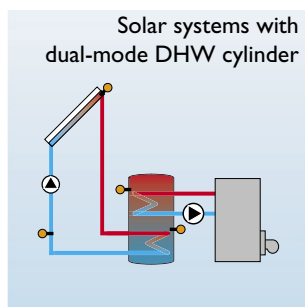
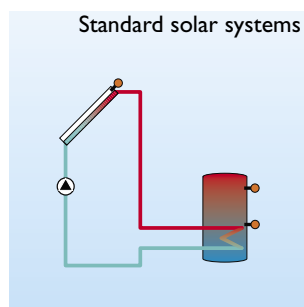
Typ 1.b

##### Breaking capacity per relay:

electromechanical relay:

4 (2) A 220 ... 240V~

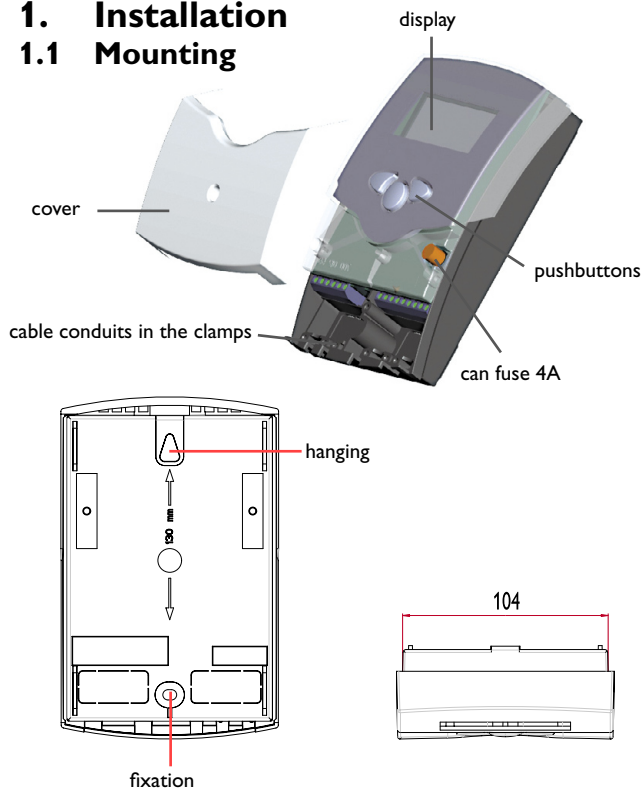


**Examples SHR 521 20**

**Please find detailed connection diagrams for these systems in chapter 1.**

## 1. Installation

### 1.1 Mounting

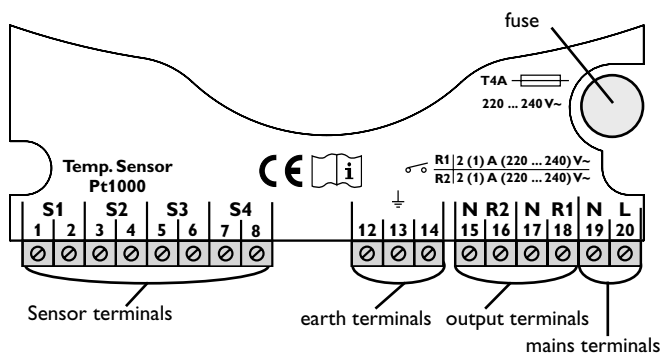


**Warning!**  
Switch-off mains supply before opening the housing.

The unit must only be located indoors. It is not suitable for installation in hazardous locations and should not be sited near to any electromagnetic field. The controller must additionally be equipped with an all-polar gap of at least 3 mm or with a gap according to the relevant installation regulations, e.g. LS-switches or fuses. Please ensure that sensor cables and AC power cables are kept well apart.

1. Unscrew the cross-head screw of the cover and remove it from the housing.
2. Mark the upper fastening point on the wall and insert the enclosed wall plug and screw.
3. Hang the housing at the upper fastening point and mark the lower fastening point on the wall (hole pitch 130 mm), afterwards put the lower wall plug.
4. Fix the housing on the wall.

### 1.2 Electrical wiring



The power supply to the controller must only be made by an external mains switch (last step of installation!) and the mains voltage must be 220 ... 240 Volt (50...60 Hz). Flexible lines are to be fixed at the housing by enclosed cable clamps and screws.

The controller is equipped with 2 relays to which the **outputs** e.g. pumps, valves etc. can be connected:

- Relay 1
  - 18 = line R1
  - 17 = neutral N
  - 13 = earth terminal ⊕
- Relay 2
  - 16 = line R2
  - 15 = neutral N
  - 14 = earth terminal ⊕

The **temperature sensors** (S1 up to S4) will be connected to the following terminals regardless of polarity:

- 1 / 2 = Sensor 1 (e.g. Sensor collector 1)
- 3 / 4 = Sensor 2 (e.g. Sensor store 1)
- 5 / 6 = Sensor 3 (e.g. Sensor TSPO)
- 7 / 8 = Sensor 4 (e.g. Sensor TRL)

The **power supply** is connected to the terminals:

- 19 = neutral N
- 20 = Line L
- 12 = earth terminal ⊕

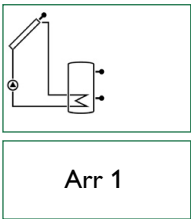


Electrostatic discharge can damage electronic components!

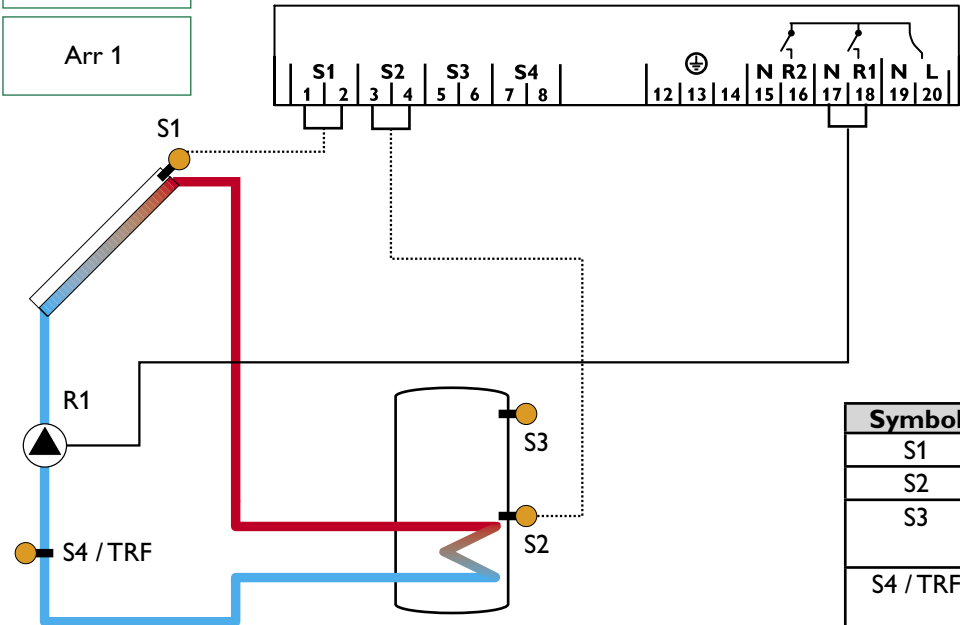


Dangerous voltage on contact!

1.2.1 Allocation of terminals for system 1

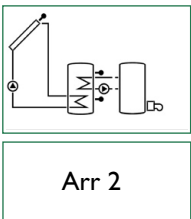


**Standard solar system** with 1 store, 1 pump and 3 sensors. The sensor S4 / TRF can optionally be used for heat quantity balancing.

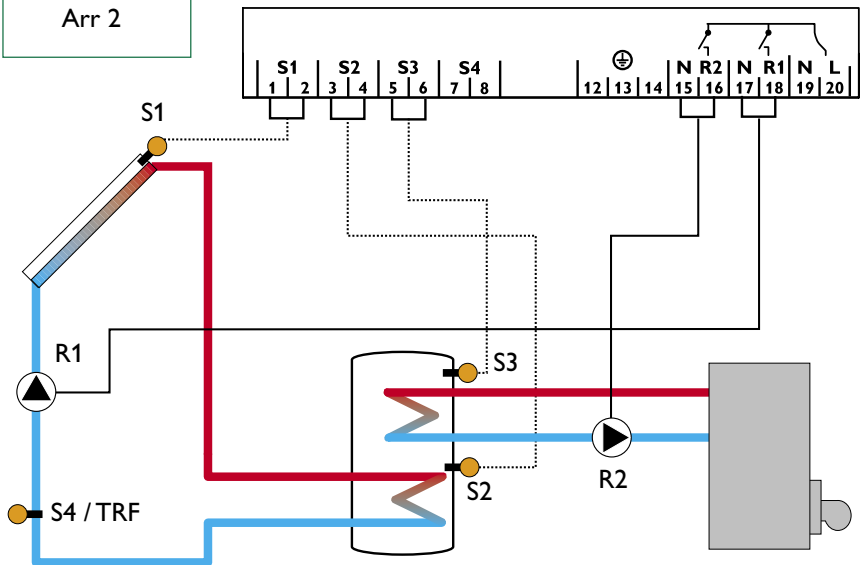


Symbol	Specification
S1	Collector sensor
S2	Store sensor lower
S3	Store sensor upper (optional)
S4 / TRF	Sensor for heat quantity measurement (optional)
R1	Solar pump

1.2.2 Allocation of terminals for system 2



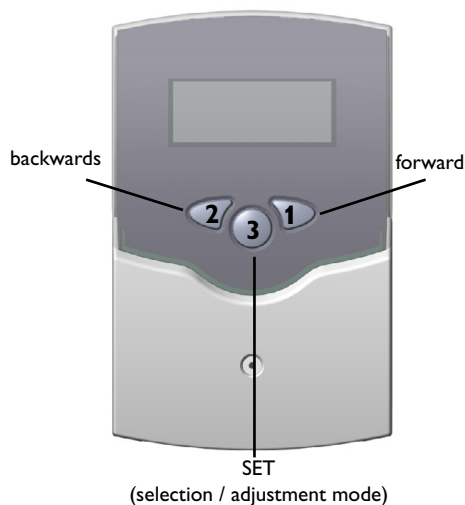
**Solar system and dual-mode DHW cylinder** with 1 store, 3 sensors and backup-heating. The sensor S4 / TRF can optionally be used for heat quantity balancing.



Symbol	Specification
S1	collector sensor
S2	store sensor lower
S3	store sensor upper
S4 / TRF	sensor for heat quantity balancing (optional)
R1	solar pump
R2	pump for heat exchange

## 2. Operation and function

### 2.1 Pushbuttons for adjustment



The controller is operated by 3 pushbuttons below the display. The forward-key (1) is used for scrolling forward through the menu or to increase the adjustment values. The backwards-key (2) is accordingly used for the reverse function.

To confirm the current mode, hold down button 1 for 2 seconds. If an **adjustment value** is shown on the display, **SEt** is indicated. In this case you can press the key „Set“ (3) in order to change into input mode.

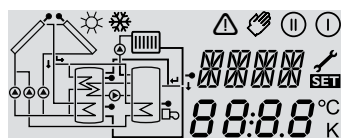
Select a mode by keys 1 and 2

Press key 3, so that „SEt“ flashes

Adjust the value by keys 1 and 2

Press key 3, so that „SEt“ permanently appears, the selected value is now saved.

### 2.2 System monitoring display



Complete monitoring-display

The system monitoring display consists of 3 blocks: **mode indication**, **tool bar** and **system screen** (active system scheme).

#### 2.2.1 Mode indication



only mode indication

The **mode indication** consists of two lines. The upper line is an alphanumeric 16-segment display, in which mainly the mode names / menu items are shown. In the lower 7-segment display, the channel values and the adjustment parameter are indicated.

Temperatures and temperature differences are indicated in °C or K.

#### 2.2.2 Tool bar

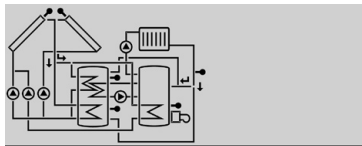


only tool bar

The additional symbols of the **tool bar** indicate the current system status.

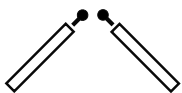
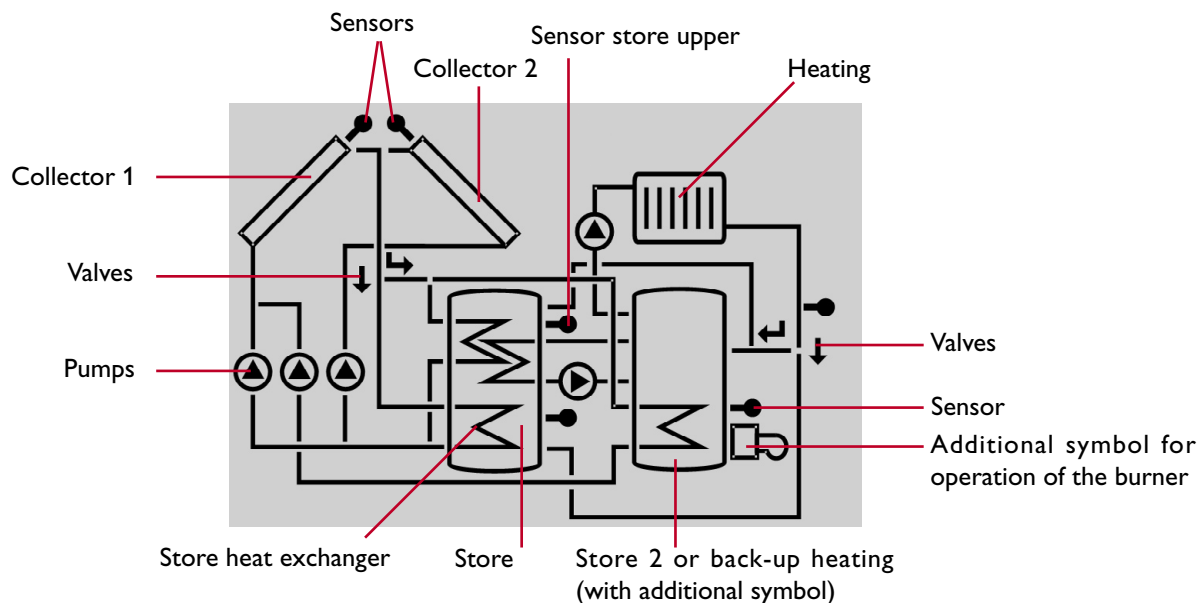
Symbol	standard	flashing
ⓘ	relay 1 active	
Ⓜ	relay 2 active	
☀	maximum store limitation active / maximum store temperature exceeded	collector cooling function or recooling function active
❄	antifreeze- function activated	collector minimum limitation or antifreeze function active
⚠		collector security shutdown or store security shutdown active
⚠ + 🔧		sensor defect
⚠ + ✋		manual operation active
SEt		an adjustment channel is changed SET-mode

### 2.2.3 System screen

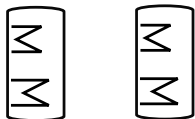


only system screen

The system screen (active system scheme) shows the schemes selected on the controller. It consists of several system component symbols, which are - depending on the current status of the system - either flashing, permanently shown or hidden.



**Collectors**  
with collector sensor



**Store 1 and 2**  
with heat exchanger



**3-way valves**  
The flow direction or the current breaking capacity are always shown.



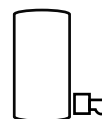
**Temperature sensor**



**Heating circuit**



**Pump**



**Back-up heat**  
with burner symbol

## 2.3 Flashing symbols

### 2.3.1 System screen flashing symbols

- Pumps are flashing during starting phase
- Sensors are flashing if the respective sensor-mode is selected.
- Sensors are flashing quickly in case of sensor defect.
- Burner symbol is flashing if back-up heat is activated.

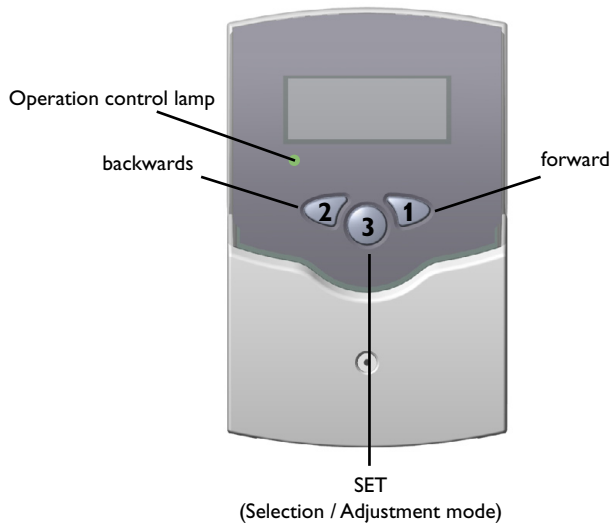
### 2.3.2 LED flashing codes

Constantly green: everything functioning correctly  
 Red/green flashing: initialisation phase  
                                   manual operation  
 Red flashing: sensor defect  
                                   (sensor symbol is flashing quickly)



### 3. Commissioning

To commission you have to adjust the solar thermal system

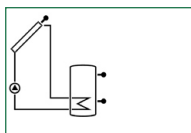


1. Ac power supply must be activated. The controller passes an initialisation phase in which the operating control lamp flashes red and green. When the initialisation is complete, the controller is in automatic operation with factory settings. The default system scheme is Arr 1.

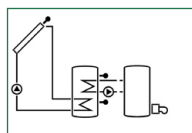
2. - select Arr

- change into **SET**-mode (see 2.1)
- select the system scheme by Arr-characteristics
- adjustment is saved by pressing button **SET**

Now the controller is ready for operation and should allow optimum operation of the solar system by the factory settings.



Arr 1



Arr 2

#### System types:

Arr 1 : standard solar system

Arr 2 : solar system with back-up heating

## 4. Control parameters and menu mode

### 4.1 Mode-overview

#### Legend:

x

Corresponding mode is available.

x\*

Corresponding mode is available if the appropriate option is activated.

#### Please note:

S3 and S4 are only indicated if sensors are connected.

①

Corresponding mode is only available if the option heat quantity measurement is **activated** (OWMZ).

②

Corresponding mode is only available if the option heat quantity measurement is **deactivated** (OWMZ).

MEDT

The mode antifreeze content (MED%) is only shown if a medium other than **water or Tyfocor LS / G-LS (MEDT 0 or 3)** is used. The adjustment is only appropriate when using other types of antifreeze.

mode	Arr		specification	page
	1	2*		
COL	x	x	Temperature collector 1	11
TST	x		Temperature store 1	11
TSTL		x	Temperature store 1 lower	11
TSTU		x	Temperature store 1 upper	11
S3	x		Temperature sensor 3	11
TRF	①	①	Temperature return flow	11
S4	②	②	Temperature sensor 4	11
h P	x		Operating hours relay 1	11
h P1		x	Operating hours relay 1	11
h P2		x	Operating hours relay 2	11
kWh	①	①	Heat quantity kWh	12
MWh	①	①	Heat quantity MWh	12
Arr	1-2		System	9
DT O	x	x	Switch-on temperature difference	13
DT F	x	x	Switch-off temperature difference	13
S MX	x	x	Maximum temperature store 1	13
EM	x	x	emergency temperature collector 1	14

mode	Arr		specification	page
	1	2		
OCX	x	x	Option collector cooling collector 1	14
CMX	x*	x*	Maximum temperature collector 1	14
OCN	x	x	Option minimum limitation collector 1	14
CMN	x*	x*	Minimum temperature collector 1	14
OCF	x	x	Option antifreeze collector 1	14
CFR	x*	x*	Antifreeze temperature collector 1	14
OREC	x	x	Option recooling	15
OTC	x	x	Option tube collector	15
AH O		x	Switch-on temp. for thermostat 1	15
AH F		x	Switch-off temp. for thermostat 1	15
OHQM		x	Option WMZ	12
FMAX	①	①	Maximum flow	12
MEDT	①	①	Antifreeze type	12
MED%	MEDT	MEDT	Antifreeze content	12
HND	x	x	Manual operation relay 1	16
HND2	x	x	Manual operation relay 2	16
LANG	x	x	Language	16
PROG	XX.XX		Program number	
VERS	X.XX		Version number	

#### 4.1.1 Indication of collector temperatures

##### COL:

Collector temperature  
display range: -40...+250 °C



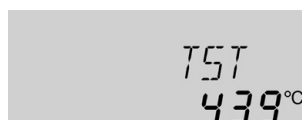
Shows the current collector temperature.

- COL : collector temperature (1-collector-system)

#### 4.1.2 Indication of store temperatures

##### TST,TSTL,TSTU:

Store temperatures  
display range: -40...+250 °C



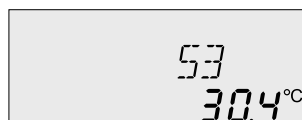
Shows the current store temperature.

- TST : store temperature (1-store-system)
- TSTL : store temperature lower
- TSTU : store temperature upper

#### 4.1.3 Indication of sensor 3 and sensor 4

##### S3, S4:

Sensor temperatures  
display range: -40...+250 °C



Shows the current temperature of the corresponding additional sensor (without control function).

- S3 : temperature sensor 3
- S4 : temperature sensor 4

##### Please note:

S3 and S4 are only indicated if the temperature sensors are connected (shown).

#### 4.1.4 Indication of other temperatures

##### TRF:

other measured  
temperatures  
display mode: -40...+250 °C



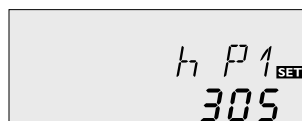
Shows the current temperature of the sensor.

- TRF : temperature return flow

#### 4.1.5 Operating hours counter

##### h P / h P1 / h P2:

Operating hours counter  
display mode



The operating hours counter adds up the solar operating hours of the respective relay (h P / h P1 / h P2). Total hours are shown on the display.

The total operating hours can be reset. When one operating hours mode is selected, the symbol **SET** is permanently shown on the display. The button SET (3) must be pressed for approx. 2 seconds in order to get back into the RESET mode of the counter. The display-symbol **SET** is flashing and the operating hours will be set to 0. In order to finish the RESET procedure, the button **SET** must be pressed in order to confirm.

To interrupt the RESET procedure, no button should be pressed for about 5 seconds. The controller returns automatically into the menu mode.

#### 4.1.6 Heat quantity balancing

**OHQM:**Heat quantity balancing

Adjustment range: OFF...ON

Factory setting: OFF



**FMAX:**

Volume flow in l/min

Adjustment range 0... 20

in steps of 0,1

Factory setting 6,0



**MEDT:** Type of antifreeze

Adjustment range 0...3

Factory setting 1



**MED%:** Concentration of antifreeze in (Vol-) %

MED% is blinded out by MEDT 0 and 3.

Adjustment range 20...70

Factory setting 45



**kWh/MWh:**Heat quantity in kWh / MWh display mode



Heat quantity balancing is possible for all systems in conjunction with a flowmeter. You just have to activate the option heat quantity balancing in the mode **OHQM**.

The flow volume read by the flowmeter (l/min) must be selected in the mode **FMAX**. Antifreeze type and concentration of the heat transfer medium are indicated in modes **MEDT** and **MED%**.

##### Type of antifreeze:

0 : water

1 : propylene glycol

2 : ethylene glycol

3 : Tyfocor® LS / G-LS

The heat quantity transferred is calculated by the flow volume and the reference sensors of feed flow S1 and return flow S4. It is shown in kWh in mode **kWh** and in MWh in the mode **MWh**. The sum of both modes form the total heat output.

The total heat quantity can be reset. As soon as one of the display modes of the heat quantity is selected, the symbol **SET** is permanently shown on the display. The button SET (3) must be pressed for approx. 2 seconds to return to the RESET mode of the counter. The display-symbol **SET** is flashing and the value for heat quantity will be set to 0. To finish the RESET-procedure, the button **SET** must be pressed for confirmation.

To interrupt the RESET-procedure, no button should be pressed for about 5 seconds. The controller returns automatically into menu mode.

#### 4.1.7 $\Delta T$ -adjustment

##### DT O:

Switch-on temperature

Adjustment range 1,0...20,0 K

Factory setting 6.0



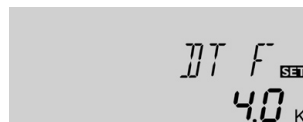
##### DT F:

Switch-off temperature diff.

Adjustment range

0,5 ... 19,5 K

Factory setting 4.0 K



**Please note:** Switch-on temperature difference DT O must be at least 1 K higher than the switch-off temperature-difference DT F.

Basically the controller works in the same way as a standard differential controller. If the switch-on difference (DT O) is reached, the pump is activated. If the selected switch-off temperature is underrun (DT F), the controller switches off.

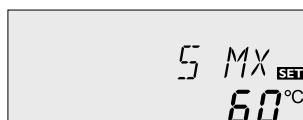
#### 4.1.8 Maximum store temperature

##### S MX:

Maximum store temp.

Adjustment range 2..95 °C

Factory setting 60 °C



If the selected maximum temperature is exceeded, a further loading of the store is stopped so that a damaging overheating can be avoided. If the maximum store temperature is exceeded, ☀ is shown on the display.

**Please note:** The controller is equipped with a safety-switch-off of the store, which avoids a further loading of the store if 95 °C are reached at the store.

#### 4.1.9 Collector temperature limit Collector emergency shutdown

##### EM:

Collector temperature limit  
Adjustment range  
110 ... 200 °C,  
Factory setting 140 °C



If the selected collector limit temperature (**EM**) is exceeded, the solar pump (R1/R2) is deactivated to avoid overheating of the solar components (collector emergency shutdown). The limit temperature is set to 140 °C but it can be changed within the adjustment range of 110 ... 200 °C. In the display  $\Delta$  (flashing) is shown.

#### 4.1.10 System cooling

##### OCX:

Option system cooling  
Adjustment OFF ... ON  
Factory setting OFF



##### CMX:

Maximum collector temp.  
Adjustment range  
100 ... 190 °C  
Factory setting 120 °C



If the selected maximum store temperature is reached, the solar system switches off. If then the collector temperature rises to the selected maximum collector temperature (**CMX**), the solar pump remains activated until the collector temperature falls below the temperature limit value. The store temperature might continue to rise (up to the maximum store temperature), but only until 95 °C (emergency shutdown of the store). If the store temperature is higher than the maximum store temperature (**SMX**) and the collector temperature is lower by at least 5 K than the store temperature, the solar system remains activated until the store is again cooled down by the collector and the pipes to the selected maximum temperature (**SMX**).

In case of active system cooling  $\star$  is shown on the display (flashing). Thanks to the cooling function the solar system can be kept running for longer periods on hot summer days and cooling of the collector and the heat transfer medium is ensured as well.

#### 4.1.11 Option minimum collector limit

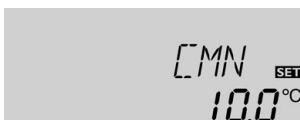
##### OCN:

Minimum collector limit  
Adjustment range OFF / ON  
Factory setting OFF



##### CMN:

Minimum collector temperature adjustment range  
-10 ... 90 °C  
Factory setting 10 °C



The minimum collector temperature is a minimum switching temperature, which must be exceeded to allow the solar pump (R1/R2) to switch on. The minimum temperature will prevent overswitching of the solar pump (or solid fuel boiler charging pumps) at low collector temperatures. If the minimum temperature is underrun,  $\star$  (flashing) is shown on the display.

#### 4.1.12 Option antifreeze function

##### OCF:

Antifreeze function  
Adjustment range  
OFF / ON  
Factory setting OFF



##### CFR:

Antifreeze temperature  
Adjustment range  
-10 ... 10 °C  
Factory setting 4,0 °C



The antifreeze function activates the loading circuit between collector and store if the selected antifreeze function is underrun in order to protect the medium from freezing or thickening. If the selected antifreeze temperature is exceeded by 1 °C, the loading circuit will be deactivated.

Please note:

As there is only a limited heat quantity of the store available for this function, the antifreeze function should only be used in regions with few days of temperatures around the freezing point.

#### 4.1.13 Recooling function

##### OREC:

option recooling  
adjustment range  
OFF...ON  
Factory setting: OFF



If the selected maximum store temperature (**S MX**) is reached, the solar pump remains activated to avoid overheating the collector. The store temperature might continue to increase but only up to 95 °C (emergency shutdown of the store).

In the evening the solar system continues running until the store is cooled down to the selected maximum store temperature via collector and pipes.

#### 4.1.14 Tube collector special function

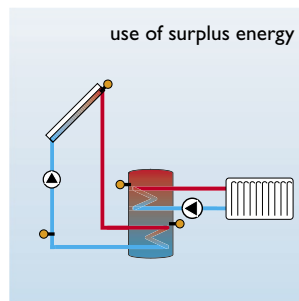
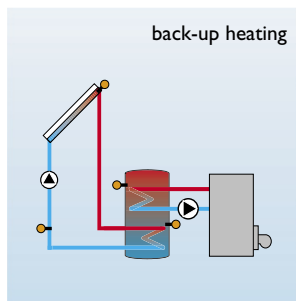
##### OTC:

Tube collector special  
function  
Adjustment range:  
OFF...ON  
Factory setting: OFF



If the controller measures an increase of 2 K compared to the latest recorded collector temperature, the solar pump is switched on to 100 % for about 30 seconds. After this period the current collector temperature is stored as new reference value. If the measured temperature (new reference value) is again exceeded by 2 K, the solar pump again switches-on for 30 seconds. If the switch-on difference between collector and store is again exceeded during runtime of the solar pump or the stopping of the system, the controller automatically switches over to solar charging. If the collector temperature drops by 2 K during this stoppage, the switch-on value for the special tube collector function will be recalculated.

#### 4.1.15 Thermostat function (Arr = 2)



The thermostat function works independently from the solar operation and can be used for use of surplus energy back-up heating.

- **AH O < AH F**  
the thermostat function is used for back-up heating
- **AH O > AH F**  
the thermostat function is used for use of surplus energy

⑩ is shown on the display if the second relay output is activated.



##### AH O:

Thermostat switch-on  
temperature  
Adjustment range:  
0,0...95,0 °C  
Factory setting: 40,0 °C



##### AH F:

Thermostat switch-off  
temperature  
Adjustment range:  
0,0...95,0 °C  
Factory setting: 45,0 °C

## 4.1.16 Operating mode

**HAND / HND1 / HND2:**

Operating mode

Adjustment range:

OFF, AUTO, ON

Factory setting: AUTO

For commissioning and service work the operating mode of the controller can be manually selected by selecting the adjustment value HAND / HND1 / HND2, in which the following adjustments can be made:

• **HAND / HND1 / HND2**

Operating mode

- OFF : relay off ⚠ (flashing) + 🖐  
 AUTO : relay in automatic operation  
 ON : relay on ⚠ (flashing) + 🖐

## 4.1.17 Language

**LANG:**

Adjustment of language

Adjustment range: dE, En, It, FR

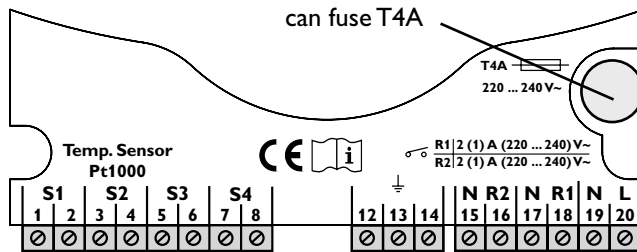
Factory setting: En

The menu language can be selected in this channel.

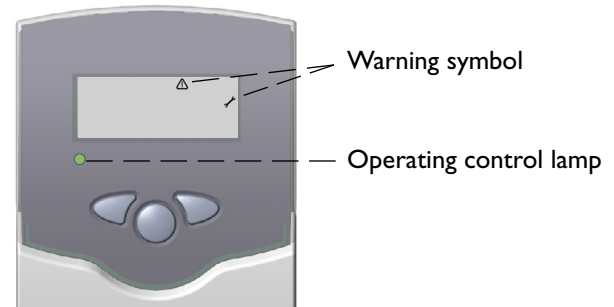
- dE : German
- En : English
- It : Italiano
- FR : French



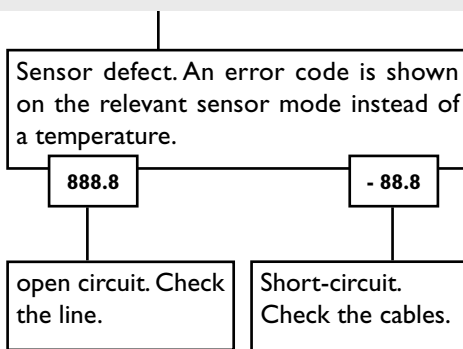
## 5. Tips for fault finding



If a malfunction occurs, a notification is given on the display of the controller:



Operating control lamp flashes red. On the display the symbol and the symbol appear.

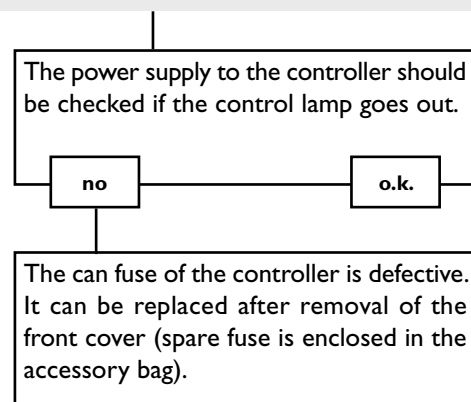


Pt1000 temperature sensors when disconnected can be checked with an ohmmeter. In the following the resistance values corresponding to different temperatures are listed.

°C	Ω	°C	Ω
-10	961	55	1213
-5	980	60	1232
0	1000	65	1252
5	1019	70	1271
10	1039	75	1290
15	1058	80	1309
20	1078	85	1328
25	1097	90	1347
30	1117	95	1366
35	1136	100	1385
40	1155	105	1404
45	1175	110	1423
50	1194	115	1442

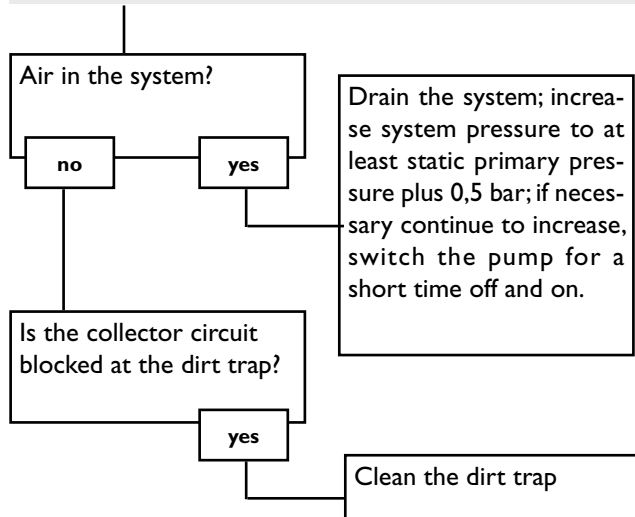
Resistance values of the Pt1000-sensors

Operating control lamp off

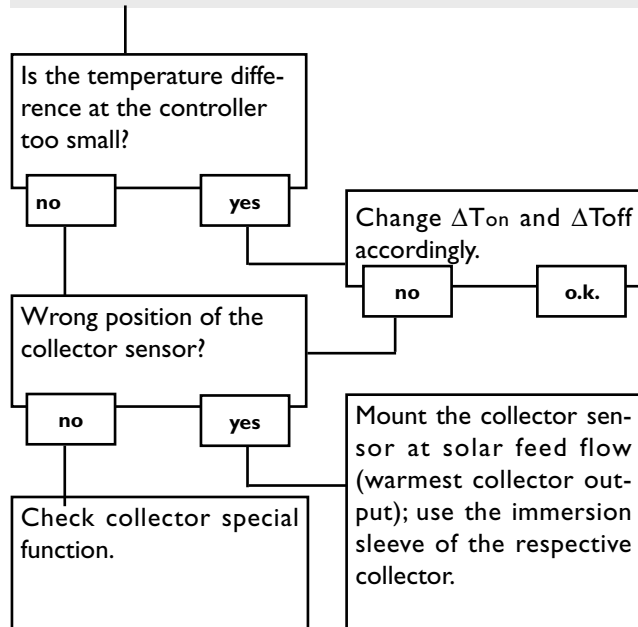


## 5.1 Various:

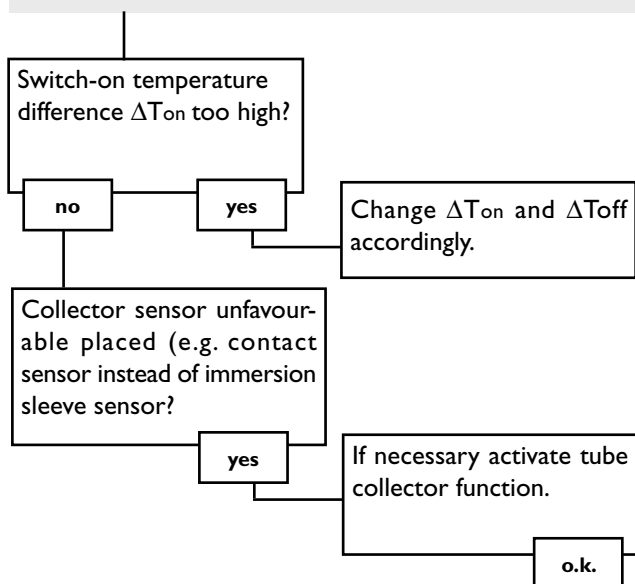
Pump is overheated, there is no heat transfer from collector to the store, feed flow and return flow are equally warm, perhaps also bubble in the lines.



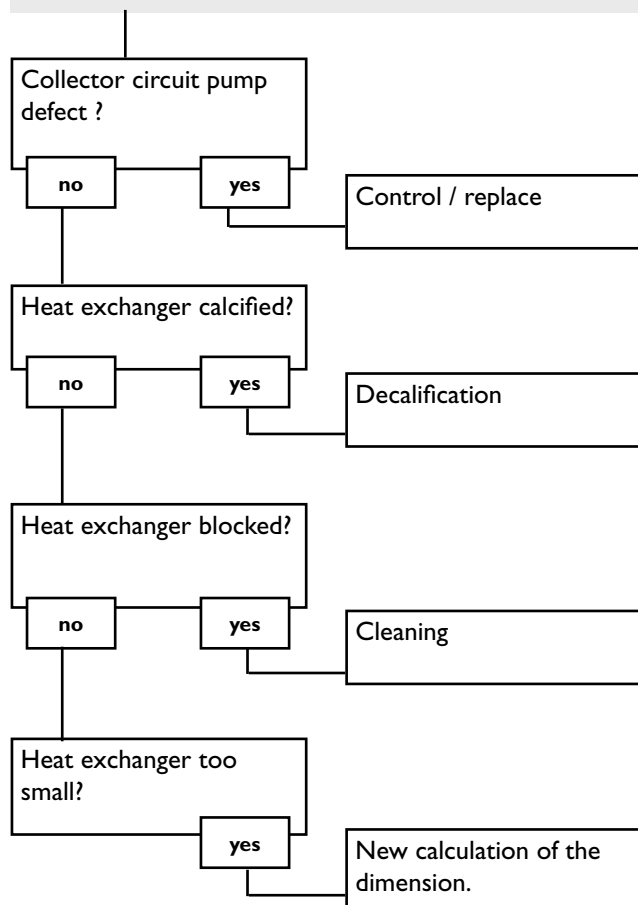
Pump starts for a short moment, switches off, switches on again, etc. ("controller hunting")



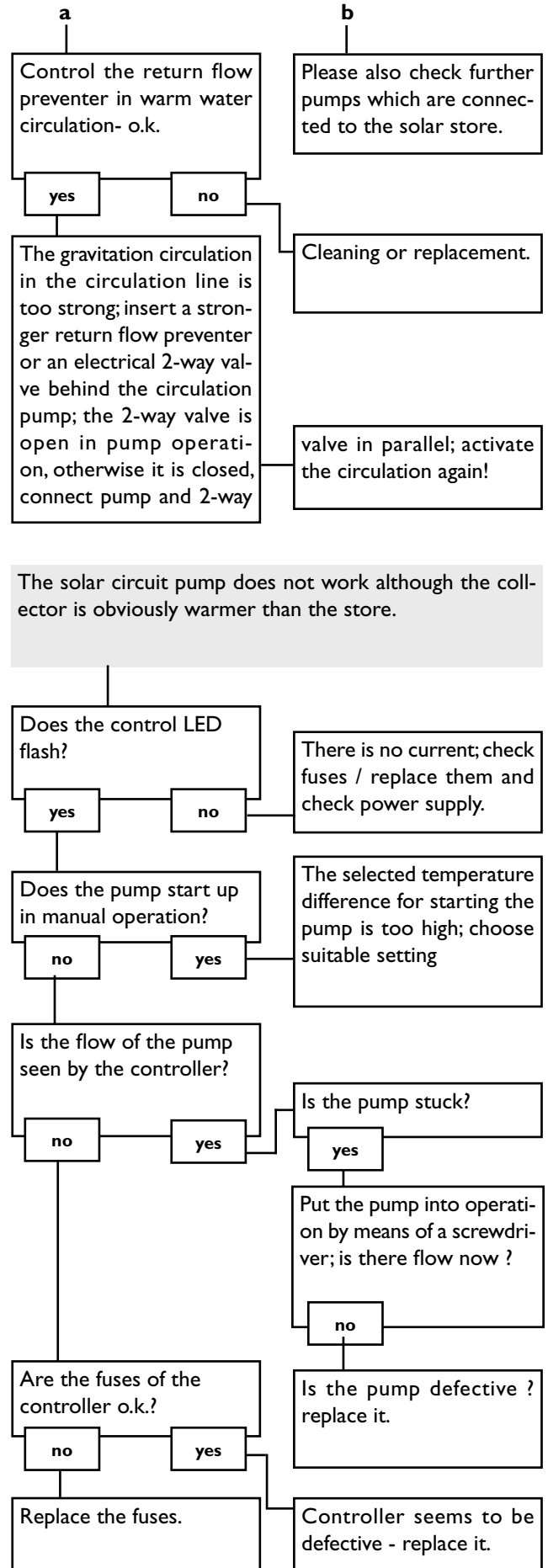
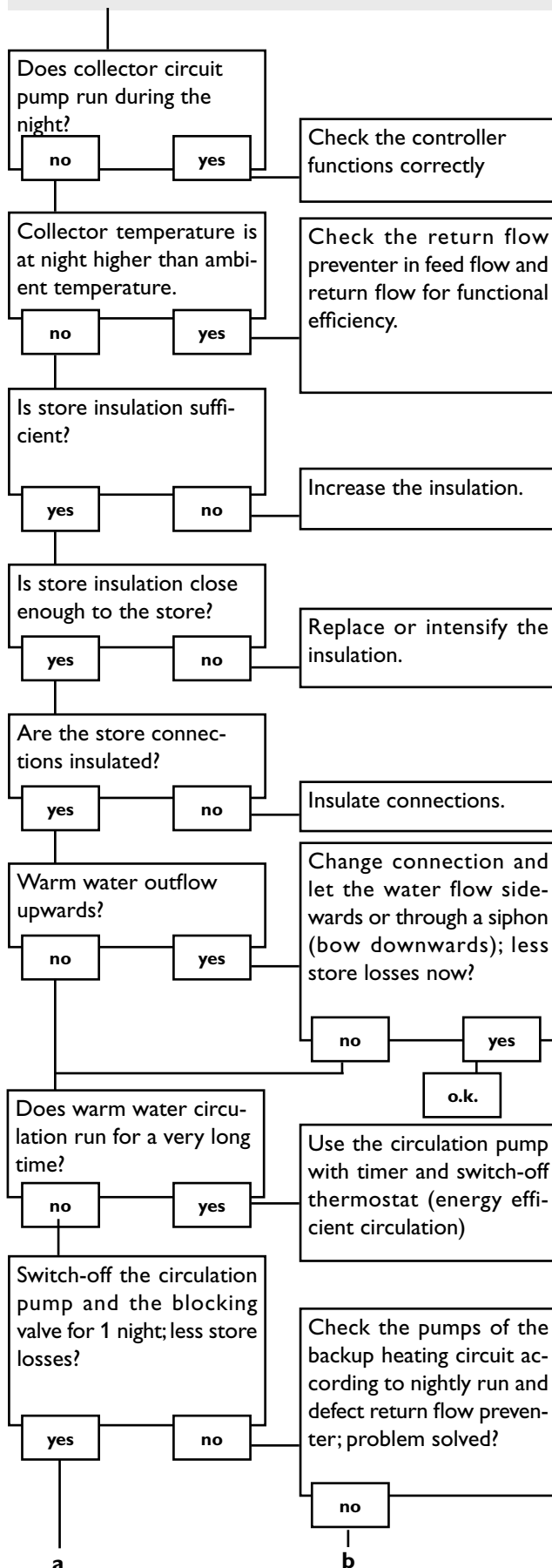
Pump starts up very late and soon stops working soon.



The temperature difference between store and collector increases enormously during operation; the collector circuit cannot dissipate the heat.



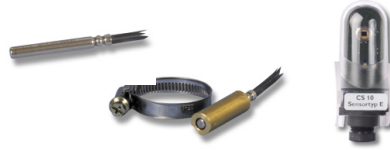
Stores are cooled during the night.



## 6. Accessories

### Sensors

Our product range includes high-precision platinum temperature sensors, flatscrew sensors, ambient temperature sensors, indoor temperature sensors, cylindrical clip-on sensors and irradiation sensors, which can be used as full sensors with sensor pocket.



### Overvoltage protection

We highly recommend installing overvoltage protection in order to avoid overvoltage damage to the collector (e.g. by lightning).



### Flowmeter

If you are interested in heat quantity balancing, you need a flowmeter for measuring the volume flow in your system.



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